STRESS IN DENTAL PATIENTS

Adrenocortical Responses in Patients Scheduled for Operative Dentistry and for Impaction Surgery

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USAF School of Aerospace Medicine
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FOREWORD

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ABSTRACT

Serum free 17-hydroxycorticosteroid levels were determined for 1,700 systemically healthy, young adult males divided into the following groups: One thousand subjects were included in a physiologic baseline study; one control group of 209 subjects was sampled over a 21-week period; a second control group of 248 participants was studied along with 97 patients scheduled for operative dentistry and 146 patients appointed for impaction surgery. All samples were collected between 7:30 and 8:00 a.m.

In the baseline study a serum free 17-OHCS mean of 14.82 (S.D. = 3.91) μg./100 ml. was found.

The means for the two control groups were not significantly different. Variances for these groups did differ ($P < .05$).

The anticipation of "having a tooth filled" was a significant ($P < .05$) stimulus to the adrenal cortex but an appointment for impaction surgery produced a significantly greater response ($P < .001$).

This technical documentary report has been reviewed and is approved.

Robert B Payne

ROBERT B. PAYNE
Colonel, USAF, MSC
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1. INTRODUCTION

It has been previously reported that the anticipation of oral surgery produced a mild yet significant hyperactivity of the adrenal cortex (1, 2, 3).

The present study was designed to investigate this anticipatory response further by evaluating patients not scheduled for dental operations of any type, those appointed for operative dental procedures, and those anticipating the removal of an impacted lower third molar. Two control groups were included to test the homogeneity of such groups in experiments of this type. Further, a large group of normal subjects was sampled to provide physiologic baselines for our experimental population. Laboratory performance of the analytical procedure was also evaluated.

2. MATERIALS AND METHODS

Certain experimental conditions were common to all phases of this study. The subjects were systemically healthy males between 17 and 22 years of age whose environmental conditions have been previously described (1, 2, 3). A venous blood sample was drawn from each participant at between 7:30 and 8:00 a.m. and serum free 17-hydroxycorticosteroid (17-OHCS) concentration was determined by the method of Peterson et al. (4), which utilized the Porter-Silber (5) color reaction with phenylhydrazine-sulfuric acid.

Duplicate steroid determinations were performed on 20 sera to test the reproducibility of the method, and efforts were made to recover measured amounts of steroid that were added to pooled human sera. In the baseline experiment, 1,000 subjects were sampled. Control group 1 in the dental study was made up of 248 randomly selected subjects who were sampled over the same time period as the experimental subjects. Control group 2 included 209 subjects, 9 to 11 of whom were sampled on a particular day of each week. Collections for this group were thus made over a prolonged time period. Neither of these control groups was scheduled for dental procedures of any type. In the dental experimental groups, 97 of the subjects had known for at least 48 hours that they were scheduled to "have a tooth filled" on the morning of the experiment while, for 146 additional participants, conditions were the same except that each expected to "have an imbedded wisdom tooth removed."

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3. RESULTS AND DISCUSSION

In analyzing the performance of the laboratory method, a mean of 13.62 μg./100 ml. was found for the 40 determinations on the 20 sera. The average difference between duplicates was 0.329 μg./100 ml. and the standard deviation of this difference was 0.768 μg./100 ml. The coefficient of variation of the method (S.D. × 100 divided by mean) was found to be 5.8%. In the recovery study, measured amounts of hydrocortisone were added to pooled human sera to produce theoretic steroid concentrations of 23.49, 29.74, 37.54, and 39.50 μg./100 ml. Determined steroid values for these test preparations were 21.22, 27.35, 36.64, and 38.61 μg./100 ml., respectively.

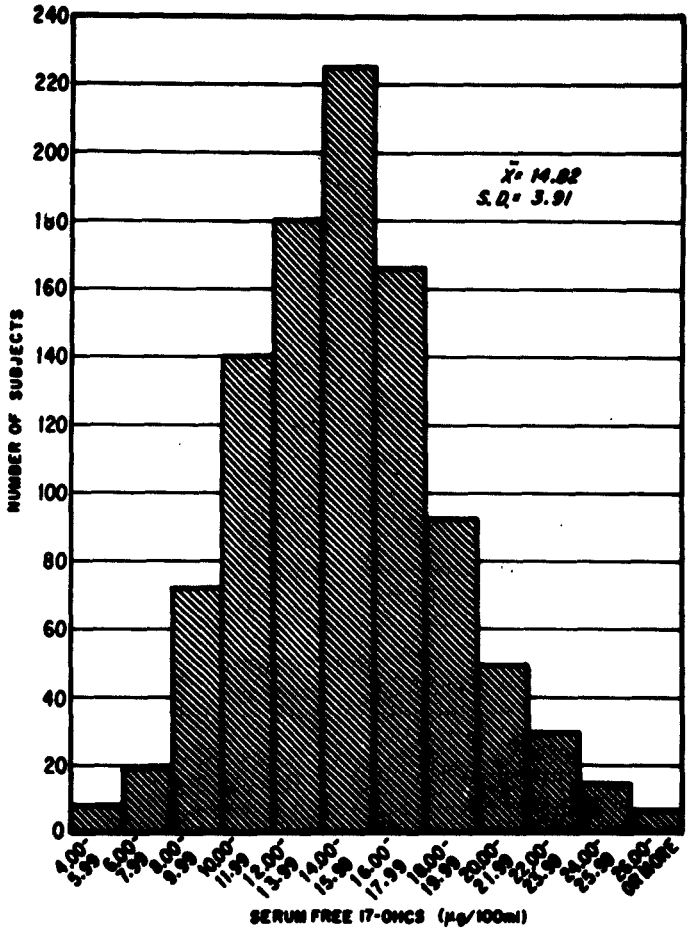

FIGURE 1

Frequency distribution for serum free 17-OHCS levels.

For the 1,000 subjects in the baseline study, a serum free 17-OHCS mean of 14.82 (S.D. = 3.91) µg./100 ml. was found. The frequency distribution of these steroid values is shown in figure 1. The 25th, 50th, and 75th percentiles for these measurements were 12.08, 14.59, and 17.12 µg./100 ml., respectively.

Means and standard deviations for the two control and two experimental groups in the dental study are shown in figure 2. The means for the two groups were not significantly different, although the variance for control group 2 was significantly ($P < .05$) lower than that for control group 1. For this reason and since the participants in control group 1 were sampled during the same time interval as were the dental patients, this group was taken as the true controls for comparison with the experimental subjects.

An analysis of variance was performed upon the data for the 248 subjects in the control group, the 97 patients who were scheduled for operative dentistry, and the 146 patients appointed for impaction surgery. The

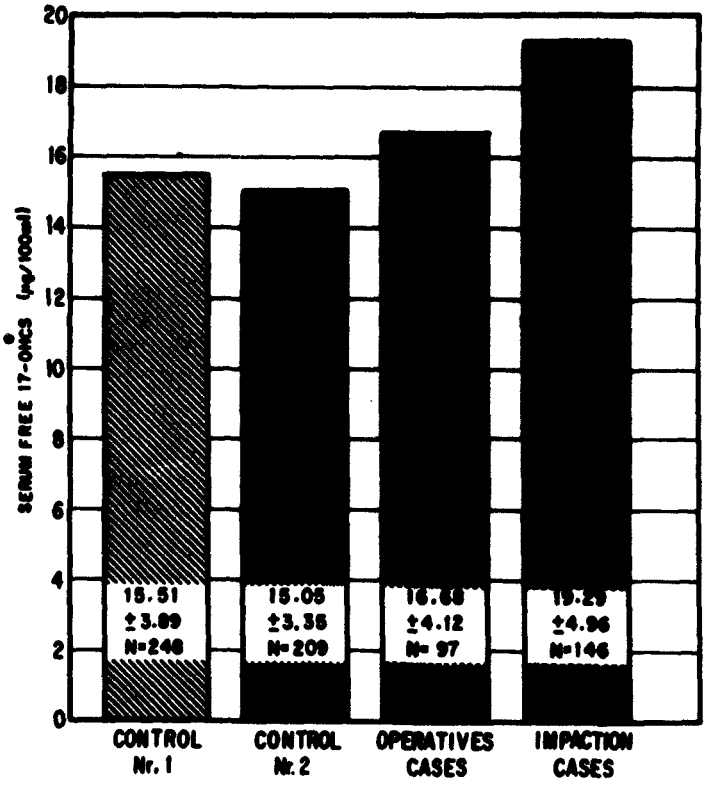

FIGURE 2

Serum free 17-OHCS means as influenced by dental appointments.

variances for these three groups differed significantly ($P < .01$). Similar significant differences were also found for the group means. The operative patients had a significantly ($P < .05$) higher steroid mean than did the control group. Other intergroup differences, controls vs. impactions and impactions vs. operative patients, were significant at the .001 level.

For these three groups, all the samples in each group were divided into first and second halves, and means and variances were calculated for each half group. The two estimates of variance were not significantly different for any of the groups. However, the means for the impaction cases differed at the .05 level. No positive interpretation can be given for this seeming discrepancy except that the nature of the impaction procedure understandably produces a much more marked anticipatory response than does the anticipation of having a tooth filled or, for that matter, of having a fully erupted tooth removed (3). With this wider spread in preoperative values, the chance for differences within the group becomes more pronounced.

The findings of the present study confirm previous observations that the average dental patient presents for treatment in a state of mild, yet significant, adrenocortical hyperactivity and that the degree of this hyperfunction is directly related to the severity of the impending treatment procedure. No claim can be made that this mild form of stimulation is

of pathologic importance systemically, even though it is well established that prolonged adrenocortical hyperactivity can be damaging. Rather, this quite predictable patient response is suggested as an objective method of evaluating the reaction of patients to dental procedures. In this way the relative strain of different operations can be studied and, if readjustment is indicated, therapeutic measures may be instituted.

REFERENCES

1. Shannon, I. L., J. R. Prigmore, W. R. Hester, C. M. McCall, Jr., and G. M. Isbell. Stress in dental patients: I. Serum free 17-hydroxycorticosteroids, sodium and potassium in subjects undergoing local anesthesia and simple exodontic procedures. J. Oral Surg. 19:486 (1961).

2. Shannon, I. L., G. M. Isbell, J. R. Prigmore, and W. R. Hester. Stress in dental patients: II. The serum free 17-hydroxycorticosteroid response in routinely appointed patients undergoing simple exodontia. Oral Surg. 15:1142 (1962).

3. Shannon, I. L., L. Szmyd, and J. R. Prigmore. Stress in dental patients: Serum and urine 17-hydroxycorticosteroid responses in impaction patients. USAF School of Aerospace Medicine Report 62-59, Apr. 1962.

4. Peterson, R. E., A. Karrer, and S. L. Guerra. Evaluation of Silber-Porter procedure for determination of plasma hydrocortisone. Anal. Chem. 29:144 (1957).

5. Porter, C. C., and R. H. Silber. A quantitative color reaction for cortisone and related 17,21-dihydroxy-20-ketosteroids. J. Biol. Chem. 185: 201 (1950).

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3. Surgery, oral

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